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RESUSCITATING APPARATUS.

APPLICATION FILED JAN. 12, 1911.

1,087,942.

Patented Feb. 24, 1914.

2 SHEETS—SHEET 1.

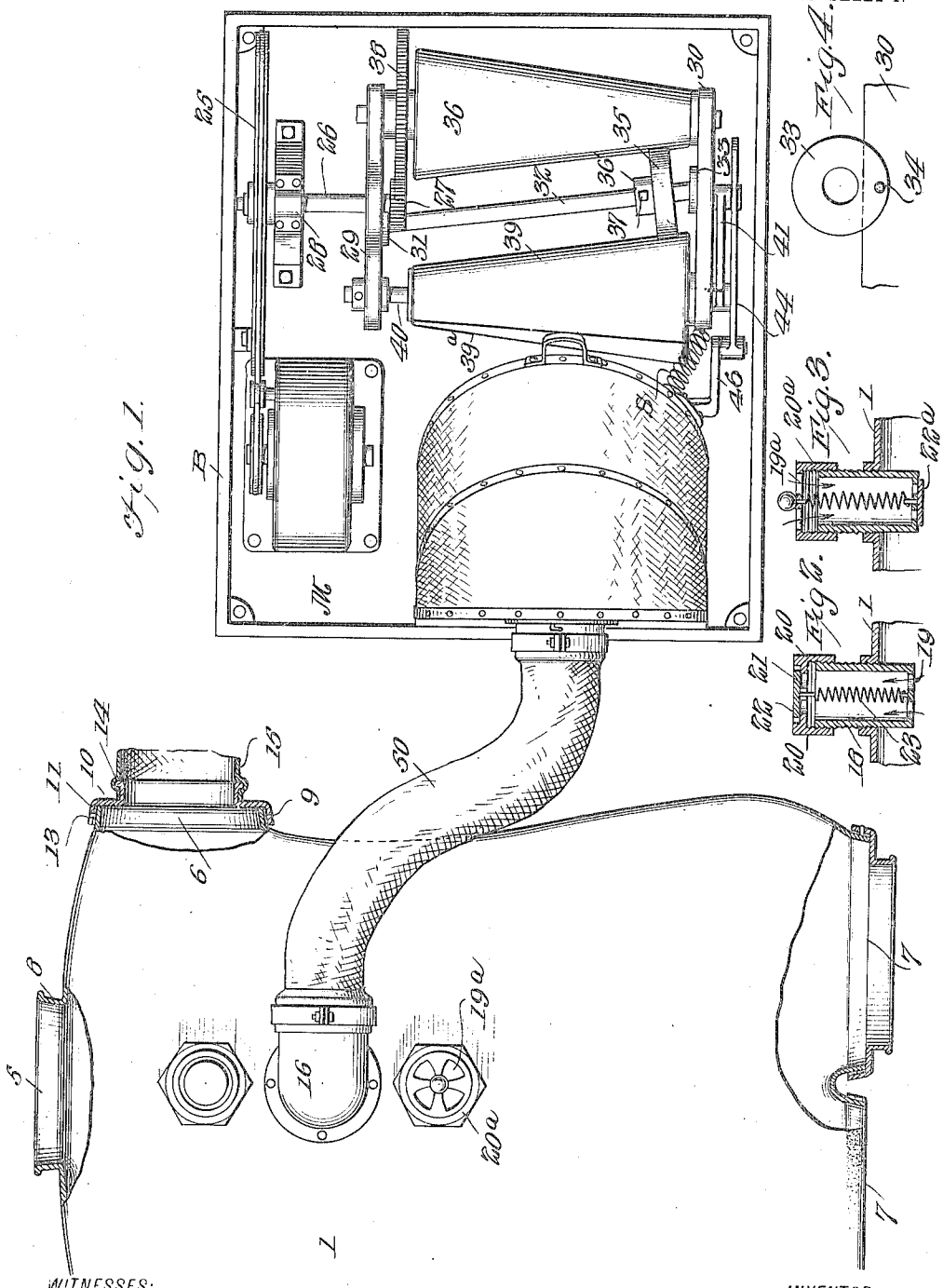


Fig. 1.

Fig. 4.

Fig. 3.

Fig. 2.

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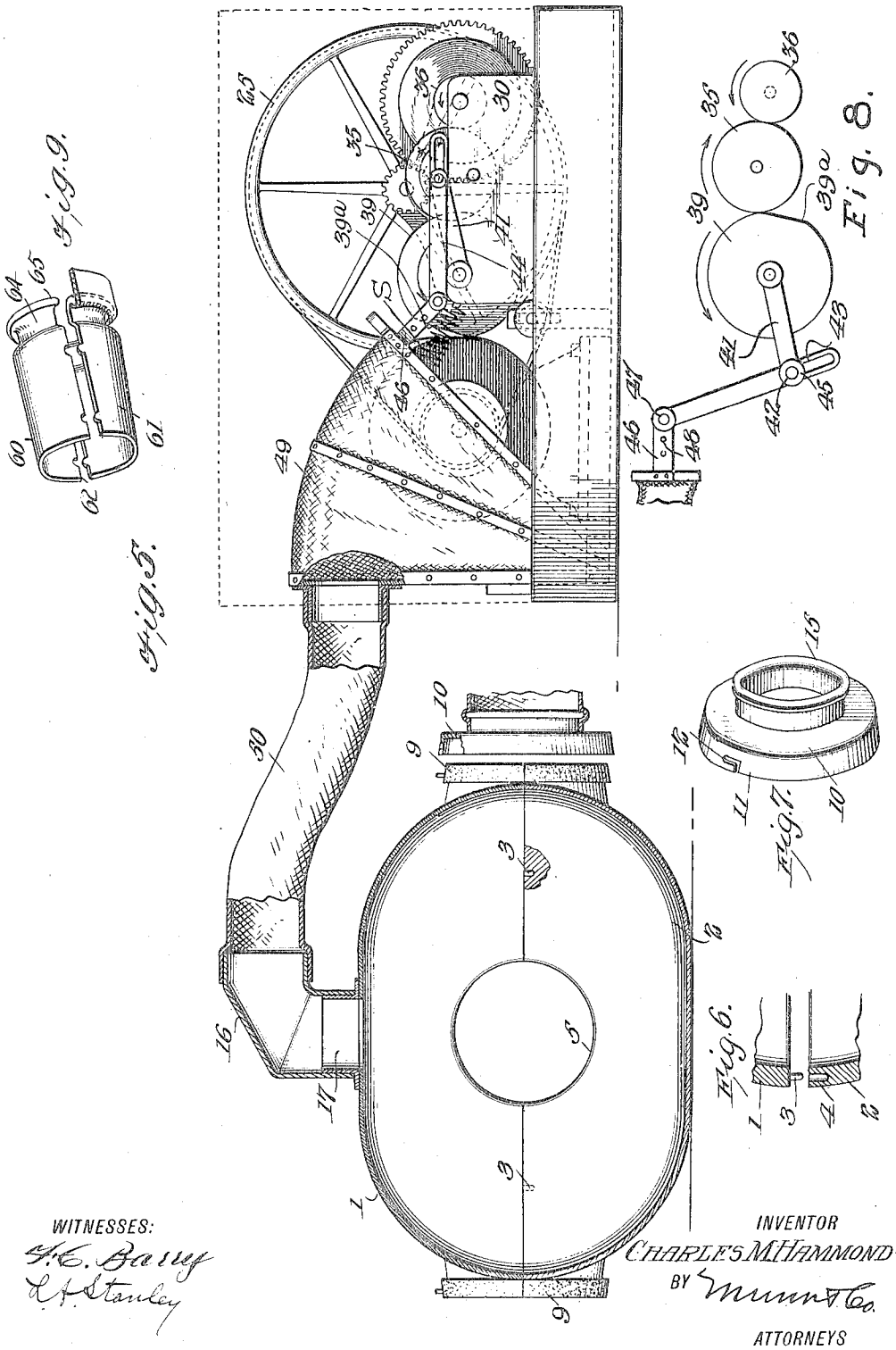
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RESUSCITATING APPARATUS.

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To all whom it may concern:

Be it known that I, CHARLES M. HAMMOND, a citizen of the United States, and a resident of Memphis, in the county of Shelby and State of Tennessee, have made certain new and useful Improvements in Resuscitating Apparatus, of which the following is a specification.

My invention relates to means for producing artificial respiration, and it consists in the constructions, combinations and arrangements herein described and claimed.

An object of my invention is to provide a casing which may be placed over the body of a patient and through which the arms neck and legs may project. This casing forms an air space which may be relieved of the external air pressure, thereby causing the air within the lungs to expand and a rush of air through the air passages into the lungs, similar to the movement of air caused in natural breathing.

A further object of my invention is to provide means for alternately relieving pressure in the casing and restoring the original pressure in order to facilitate the inhalation and the exhalation of the patient.

A further object of my invention is to provide a casing which is large enough to admit a body of any size with means for closing the space around the arms, neck and legs of the patient when the latter is within the casing. These means are adjustable so as to fit limbs of various size.

A further object of my invention is to provide means whereby the rapidity as well as the intensity of the alternate rarefactions and condensations may be regulated.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this specification in which—

Figure 1 is a plan view showing one embodiment of my invention. Fig. 2 is a sectional view of a valve for regulating the pressure within the casing. Fig. 3 is a sectional view of another valve for regulating the rarefaction within the casing. Fig. 4 is a side view of an oscillating shaft bearing. Fig. 5 is a side view of the pneumatic mechanism, the casing being shown in section. Fig. 6 is a detail view showing a dowel pin and its seating. Fig. 7 is a view of a detachable collar. Fig. 8 is a detail view showing a portion of the driving mechanism for the bellows, and Fig. 9 is a perspective view of a modified neck piece.

In carrying out my invention I provide a casing having an upper portion 1 and a lower portion 2, these portions being arranged to fit together accurately by means of dowel pins 3, in one portion, which enter sockets 4 in the other portion, as shown in Fig. 6. The casing is made preferably in the shape of a torso and is large enough to receive the body of a patient of any size. When the sections are joined together as shown in Fig. 5, there is an opening 5 for the neck, and openings 6 for the arms, and openings 7 for the legs. The casing may be made of any suitable material but I prefer to make it of some light material such as aluminum in order to withstand any strain to which it may be put. Around the opening 5 is a flanged collar 8, while around the openings 6 and 7 are beveled collars 9. The purpose of beveling this collar is to permit the attachment of a movable collar 10 such as that shown in Fig. 7. This collar is provided with a flange 11 which is beveled so as to fit over the flange 9. It is provided with an L-shaped slot 12 arranged to take over a pin 13 on the collar 9 in the manner of a bayonet joint. The collar 10 is provided with a flange 14, see Fig. 1, over which may be stretched a resilient band 15 of rubber or other suitable material. It is my purpose to make the collars 10 with various sized openings each provided with a band similar to that shown at 15 in order to accommodate patients having limbs of different size. This I consider an important feature of my invention. Moreover, as will be plainly seen from Fig. 5 the placing of the collar 10 on the collar 9 secures the two parts of the main casing 1 and 2 together when by slightly rotating the collar 10 these parts will be locked and the collar 10 will be locked to the collar 9. These removable collars are provided for the arm and leg holes. Leading from the upper part of the casing is a pipe 16 which fits over a collar 17 secured to the member 1. The member 1 is provided with two valves, one like that shown in Fig. 2, and one like that shown in Fig. 3. In Fig. 2, the valve

consists of a threaded member 18 arranged to enter a threaded opening in the member 1. The lower part of the member 18 is provided with openings 19 through which air can pass into the valve. The top part of the valve has a screw-cap 20 having an opening 21 which is adapted to be closed by a valve 22. A spring 23 holds the valve normally against its seat.

The valve shown in Fig. 3, is similar to that in Fig. 1 except that the valve 22^a is on the bottom and the screw-cap 20^a is provided with openings 19^a through which air can enter downwardly into the valve casing.

The apparatus for producing rarefaction and condensation of the air within the casing is illustrated in Figs. 1 and 5. It consists of a box B within which is secured a motor M. In the illustration I have shown an electric motor, but obviously other means such as a hand-crank might be used without departing from the spirit of the invention. The motor M is belted to a drive wheel 25 which is mounted on a shaft 26 whose end bears a gear 27. Appropriate bearings 28 and 29 are provided. Secured within the box is a bearing 30 which is somewhat similar in construction to the bearing 29. The latter is provided with a flange 31 which constitutes the bearing for an inclined shaft 32. The opposite end of the shaft 32 is journaled in a bearing 33 which is pivotally secured at 34 to the bearing 30 as shown in Fig. 4. The shaft 32 bears a movable friction wheel 35 which is provided with a collar 36′ having a set screw 37 so that the friction wheel 35 may be moved longitudinally of the shaft 32 and can be secured in any position therealong. As shown in the drawings I provide two cones, each of which is carried by the bearings 29 and 30. One of the cones 36 is provided with a driving gear 38 which meshes with the gear 27. The cone 39 is driven by the cone 36 through the medium of the friction wheel 35. It will be seen that this cone 39 has a flattened portion 39^a for a purpose hereinafter explained.

The shaft 40 of the cone 39 projects through the bearing 30 and is provided on its outer end with a crank arm 41. The latter bears a pin 42 at one end which is adapted to project through a slot 43 in a link 44. A head 45 is provided for the pin. The end of the link 44 may be pivotally secured to an arm 46 at various places therealong by means of the pin 47 which is arranged to extend in the openings 48, see Fig. 8. The arm is attached to a bellows 49 which is screwed to the frame of the box B. The bellows communicates with the tube 16 by means of a flexible pipe 50 as shown in Fig. 5. A spring S keeps the bellows normally in a retracted position as shown in Fig. 5.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

The patient is placed in the casing and the two halves of the casing are placed together. The neck of the casing is closed by means of a rubber band similar to the band 15 which prevents air from entering the casing. The arms and legs of the patient are passed through collars similar to that shown at 10 which are secured to the casing in the manner already described, the resilient bands 15 being rolled up in the position shown in Fig. 7. As soon as the collars 10 are locked into position these bands are rolled up upon the limb so as to prevent the entrance of air into the casing. The motor is now started and the cones are caused to revolve by means of the gears 27 and 38. The revolution of the cone 36 causes the revolution of the cone 39 and the relative speeds of these cones is determined by the position of the intermediate friction wheel 35. Considering now the position of the crank arm 41 as shown in Figs. 1 and 5, it will be apparent that with the cone revolving in the direction shown by the arrow, the link 44 will be carried first upwardly and then forwardly and the pressure on the bellows will cause the latter to force air into the casing thus tending to force the air in the lungs of the patient out. It is not designed to increase the pressure much above that of the outside atmosphere and therefore the valve 22 will unseat if the pressure much exceeds this amount, letting out the air. On the further revolution of the cone 39 the flattened surface 39^a comes into registration with the driving wheel 35. At the same time the link 44 will be in a position to move to the rear *i. e.*, in a direction away from the bellows. The bellows is under the tension of the spring S and since the cone 39 is now free of the drive wheel 35 (on account of the flattened surface 39^a) the bellows will be free to spring back, the link 44 being moved to the rear by the movement of the bellows. This tends to forcibly withdraw air from the casing and compels the patient to inhale, or rather, produces an artificial inhalation due to a rarefaction of the air within the casing and an expansion of the air in the patient's lungs. The crank arm 41 is now moved by means of the link 44, (the latter still being under the tension of the spring S) and this turns the cone 39 until its periphery again meets that of the driving wheel 35 when the operation will be repeated. The movement of the crank arm from the position shown in Fig. 8 to that shown in Fig. 5 will cause the pin 45 to ride from one end of the slot to the other but on a further rotation of the cone 39 the pin will ride again to the forward end of the slot and repeat the operation.

It will be apparent that during a portion of the revolution of the cone 39 the bellows is at rest, *i. e.*, from the position shown in Fig. 5 until such time as the pin 45 returns to the end of the slot nearest the bellows. This will give sufficient time for the lungs of the patient to be filled with air. Further revolution of the cone 39 causes the air to be forced into the casing in the manner already described. The reason for the sudden withdrawal of the air is to overcome the natural resistance of the chest walls. Thus a device in which the exhaustion of the air is slow and regular would not suffice for the purposes of this invention, because the patient in the casing would just be beginning to get air in his lungs when the bellows would again close and force back the air, thus defeating the very object of this invention, to wit; to get the air in as rapidly as possible and to give the air time to act before being expelled from the lungs of the patient. The inactive period of the bellows, as explained above, permits this period of rest. Now when the air has done its work in the lungs of the patient it is expelled by forcing the air into the casing as heretofore explained.

From the foregoing description it will be seen that the air within the casing is alternately exhausted and forced in. In order to prevent the air from being too far exhausted I arrange the valve 22^a which when the pressure is reduced too suddenly will open and let in air from the outside, the valve 22, on the other hand, prevents the application of too great a pressure within the casing as already described.

A few instances of the use of my device will suffice to demonstrate its utility. In morphin poisoning the death of a person is not caused so much by the toxic effect of the drug itself, as by the effect on respiratory organs which are so weakened that natural respiration is soon impossible. A patient therefore who has taken this poison may be put into the casing and artificial respiration may be kept up indefinitely until he has so far recovered that it is not necessary. The same thing is true in cases of pneumonia where artificial respiration can be maintained. The degree of pressure and rarefaction can be adjusted so as to fit each case and the use of the apparatus will, of course, obviate the fatigue of an operator by the manual manipulation of the arms and chest in the ordinary means of producing artificial respiration. The apparatus can be used to resuscitate drowning persons and in cases of asphyxiation. It is obvious that the alternate withdrawal and filling of the casing with the same air will tend to heat the latter so that it is practically at the temperature of the body and in many cases it is desirable to have the surrounding atmosphere at the same temperature of the body. Other uses might be mentioned but the statement of the main uses as given above will be sufficient to show the many advantages of this improved respirometer.

In Fig. 9 I have shown a modified form of neck piece. This consists of the sections 60 and 61, which may be fitted together around the neck of the patient. These sections taper toward the end 62, which is adapted to enter the collar 5. The opposite end of the sections 60 and 61 is provided with an annular channel 64 and a flange 65. The rubber band is arranged to fit in the channel 64 and to be retained thereon by means of the flange 65. The cone-shaped collar thus formed by the members 60 and 61 may be of different size to accommodate patients of different size.

I claim:

1. In a respirometer, a casing adapted to fit the torso of a patient and having openings for the limbs of the patient, means for preventing the entrance of air through said openings, and means for causing a relatively rapid exhaustion of a portion of the air within said casing and a comparatively slow return of the air so exhausted into the casing.

2. In a respirometer, a casing comprising an upper and a lower section, said casing being adapted to inclose the torso of a patient, semi-cylindrical registering extensions on said sections arranged to form openings in the casing for the limbs of the patient, collars adapted to be locked on said registering extensions and elastic bands carried by said collars for engaging the limbs of the patient to exclude the air.

3. In a respirometer, a casing adapted to inclose the torso of a patient, a bellows, a flexible tube establishing communication between said bellows and said casing, means for exerting a sudden retraction of said bellows to withdraw the air from said casing and for forcing the air so withdrawn gradually into said casing.

4. In a respirometer, a casing comprising an upper and a lower section, said casing being adapted to inclose the torso of a patient, registering extensions on said sections arranged to form openings in the casing for the limbs of the patient, means carried by said extensions for locking the casing sections together, and means for preventing the entrance or egress of air through said openings.

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